CLAIMS

1. A multi-layer piezoelectric device comprising a stack formed by stacking piezoelectric layers and internal electrodes alternately one on another and external electrodes formed on a first side face and on a second side face of the stack, one of the adjacent internal electrodes being connected to the external electrode formed on the first side face and the other internal electrode being connected to the external electrode formed on the second side face,

wherein a content of an alkali metal is not less than 5 ppm nor more than 300 ppm.

2. The multi-layer piezoelectric device according to claim 1;

wherein the piezoelectric layers include the alkali metal of not less than 5 ppm nor more than 500 ppm.

3. The multi-layer piezoelectric device according to claim 1;

wherein the internal electrodes include the alkali metal of not less than 5 ppm nor more than 500 ppm.

4. The multi-layer piezoelectric device according to claim 1;

wherein the external electrodes include the alkali

metal of not less than 5 ppm nor more than 500 ppm.

5. The multi-layer piezoelectric device as in one of claims 1-4; wherein the alkali metal is at least one kind of Na and K.

6. The multi-layer piezoelectric device as in one of claims 1-5; further comprising a halogen element of not less than 5 ppm nor more than 1000 ppm.

7. A multi-layer piezoelectric device comprising a stack formed by stacking piezoelectric layers and internal electrodes alternately one on another and external electrodes formed on a first side face and on a second side face of the stack, one of the adjacent internal electrodes being connected to the external electrode formed on the first side face and the other internal electrode being connected to the external electrode formed on the second side face,

wherein a content of a halogen element content is not less than 5 ppm nor more than 1000 ppm.

8. The multi-layer piezoelectric device according to claim 7; wherein the piezoelectric layers include the halogen element of not less than 5 ppm nor more than 1500 ppm.

9. The multi-layer piezoelectric device according to claim 7; wherein the internal electrodes include the halogen element of not less than 5 ppm nor more than 1500 ppm.

10. The multi-layer piezoelectric device according to claim 7; wherein the external electrodes include the halogen element of not less than 5 ppm nor more than 1500 ppm.

11. The multi-layer piezoelectric device as in one of claims 7-10; wherein the halogen element is at least one kind of Cl and Br.

12. A multi-layer piezoelectric device comprising a stack formed by stacking piezoelectric layers and internal electrodes alternately one on another and external electrodes formed on a first side face and on a second side face of the stack, one of the adjacent internal electrodes being connected to the external electrode formed on the first side face and the other internal electrode being connected to the external electrode formed on the second side face,

wherein a ratio of change in the device dimension after undergoing 1×10^9 cycles of continuous operation to the initial device dimension is not larger than 1%.

13. The multi-layer piezoelectric device according to claim

12;

wherein a ratio of change in thickness of the internal electrode after undergoing 1×10^9 cycles of continuous operation to the initial thickness of the internal electrode is not larger than 5%.

14. The multi-layer piezoelectric device as in one of claims 1-13; wherein an inorganic component is added along with the metallic component in the internal electrode.

15. The multi-layer piezoelectric device according to claim 14;

wherein the inorganic component contains perovskite type oxide consisting of $PbZrO_3$-$PbTiO_3$ as the main component.

16. The multi-layer piezoelectric device as in one of claims 1-15; wherein the piezoelectric layer contains perovskite type oxide as the main component.

17. The multi-layer piezoelectric device according to claim 16;

wherein the piezoelectric layer contains perovskite type oxide consisting of $PbZrO_3$-$PbTiO_3$ as the main component.

18. The multi-layer piezoelectric device as in one of

claims 1-17; wherein firing temperature of the stack is not less than 900 nor more than 1000°C.

19. The multi-layer piezoelectric device as in one of claims 1-18; wherein a deviation in the composition of the internal electrode that is caused by the firing is not more than 5%.

20. A multi-layer piezoelectric device made by stacking piezoelectric layers and internal electrodes alternately one on another, wherein the piezoelectric layer contains $PbTiO_3$-$PbZrO_3$ as a main component and contains Si of not less than 5 ppm nor more than 100 ppm.

21. The multi-layer piezoelectric device according to claim 20; wherein Si is segregated in the crystal grain boundary and thickness of the grain boundary is not larger than 1 nm.

22. The multi-layer piezoelectric device as in one of claims 1-21; wherein the metal compound in the internal electrode contains group VIII metal and/or group Ib metal as the main components.

23. The multi-layer piezoelectric device according to claim 22; wherein a proportion M1 (% by weight) of the group VIII

metal and a proportion M2 (% by weight) of the group Ib metal in the internal electrode satisfy relations $0 < M1 \leq 15$, $85 \leq M2 < 100$ and $M1 + M2 = 100$.

24. The multi-layer piezoelectric device according to claims 22 or 23; wherein the group VIII metal is at least one kind selected from a group consisting of Ni, Pt, Pd, Rh, Ir, Ru and Os, and the group Ib metal is at least one kind selected from a group consisting of Cu, Ag and Au.

25. The multi-layer piezoelectric device as in one of claims 22-24; wherein the group VIII metal is at least one kind selected from a group consisting of Pt and Pd, and the group Ib metal is at least one kind selected from a group consisting of Ag and Au.

26. The multi-layer piezoelectric device as in one of claims 22-25; wherein the group Ib metal is Cu.

27. The multi-layer piezoelectric device as in one of claims 22-25; wherein the group VIII metal is Ni.

28. The multi-layer piezoelectric device as in one of claims 1-27; wherein the internal electrode includes voids and the voids occupy 5 to 70% of cross sectional area of the

internal electrode.

29. The multi-layer piezoelectric device as in one of claims 1-27;

wherein a groove is formed between the end of the other internal electrode and the external electrode on the first side face, with the groove being filled with an insulating material and a groove is formed between the end of the one internal electrode and the external electrode on the second side face, with the groove being filled with an insulating material, the insulating material having Young's modulus lower than that of the piezoelectric layer.